

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
26 February 2004 (26.02.2004)

PCT

(10) International Publication Number  
**WO 2004/017299 A1**

(51) International Patent Classification<sup>7</sup>: **G09G 03/38**

(74) Agent: VAN DEN HOOVEN, Jan; Philips Intellectual Property & Standards, Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(21) International Application Number:  
PCT/IB2003/002973

(22) International Filing Date: 2 July 2003 (02.07.2003)

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
02078379.1 15 August 2002 (15.08.2002) EP

(71) Applicant (*for all designated States except US*): KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

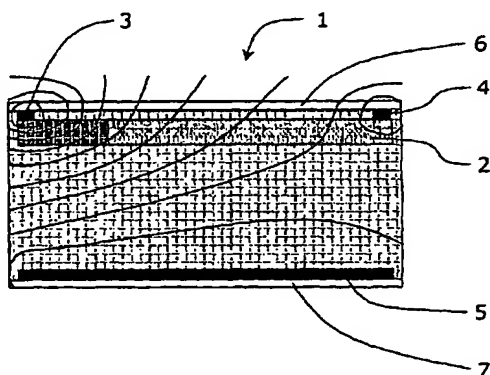
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventor; and

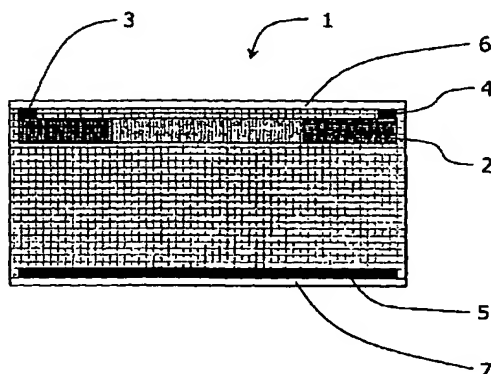
(75) Inventor/Applicant (*for US only*): JOHNSON, Mark, T. [GB/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

[Continued on next page]

(54) Title: AN ELECTROCHROMIC DISPLAY WITH ANALOG INTRINSIC FULL COLOR PIXELS



(57) Abstract: A display device comprising a plurality of independently addressable pixels (1). Each pixel comprises: a first substrate (6); a second substrate (7); a polyelectrochromic material (2) disposed between said first substrate (6) and said second substrate (7). At least two independent electrodes (3, 4) are associated with said first substrate (6). An independent counter-electrode (5) is associated with said second substrate (7). Each respective electrode is connected to an independently controllable voltage source. The display device has means for controlling the voltage applied to each respective electrode (3, 4, 5) for producing non-uniform electric fields in each pixel (1), for causing partial switching of the polyelectrochromic material (2) from a first color state to a second color state to generate an area ratio defined pixel color state.



**Declaration under Rule 4.17:**

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU,

TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

**Published:**

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

## INTERNATIONAL SEARCH REPORT

PCT/IB 03/02973

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 G09G3/38

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 G09G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, COMPENDEX, INSPEC

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category * | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|------------|---|-----------------------|
| Y          | WO 91 15800 A (MAKOW DAVID M)<br>17 October 1991 (1991-10-17)<br>page 7, line 34 -page 8, line 7<br>page 9, line 31 -page 10, line 12<br>page 12, line 3 - line 5<br>page 11, line 20 - line 28; figure 1<br>---    | 1-11                  |
| Y          | US 4 371 236 A (NICHOLSON MARGIE M)<br>1 February 1983 (1983-02-01)<br>cited in the application<br>column 2, line 25 - line 27<br>column 2, line 63 -column 3, line 8<br>column 3, line 29 - line 31<br>---<br>-/-- | 1-11                  |

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

30 October 2003

Date of mailing of the international search report

06/11/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Gundlach, H

## INTERNATIONAL SEARCH REPORT

PCT/IB 03/02973

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|------------|--|-----------------------|
| Y          | EP 0 549 337 A (SHARP KK)<br>30 June 1993 (1993-06-30)<br>column 4, line 37 - line 44<br>column 5, line 1 - line 5; figure 3<br>column 5, line 45 -column 6, line 23<br>---- | 1-11                  |
| Y          | US 4 469 449 A (KATO TOSHIKIYO)<br>4 September 1984 (1984-09-04)<br>column 14, line 58 - line 61; figure 1<br>column 15, line 65 -column 16, line 47<br>----                 | 3,4,9                 |
| Y          | WO 00 45365 A (MICROSOFT CORP)<br>3 August 2000 (2000-08-03)<br>page 8, line 15 - line 20; figure 1<br>-----   | 5,6,9                 |

## INTERNATIONAL SEARCH REPORT

PCT/IB 03/02973

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s)  | Publication<br>date  |
|---|---|---------------------|---|--|
| WO 9115800                                | A | 17-10-1991          | CA 2013776 A1<br>AU 7342991 A<br>WO 9115800 A1  | 04-10-1991<br>30-10-1991<br>17-10-1991   |
| US 4371236                                | A | 01-02-1983          | US 4184751 A<br>FR 2456357 A1<br>JP 3008524 B<br>JP 56500822 T<br>WO 8002462 A1<br>CA 1089062 A1<br>DE 2756551 A1<br>GB 1578600 A<br>JP 1309367 C<br>JP 53077494 A<br>JP 60032168 B<br>US 4306774 A | 22-01-1980<br>05-12-1980<br>06-02-1991<br>18-06-1981<br>13-11-1980<br>04-11-1980<br>22-06-1978<br>05-11-1980<br>26-03-1986<br>08-07-1978<br>26-07-1985<br>22-12-1981 |
| EP 0549337                                | A | 30-06-1993          | JP 2882925 B2<br>JP 5173511 A<br>EP 0549337 A1  | 19-04-1999<br>13-07-1993<br>30-06-1993   |
| US 4469449                                | A | 04-09-1984          | JP 58100896 A<br>GB 2114797 A , B   | 15-06-1983<br>24-08-1983   |
| WO 0045365                                | A | 03-08-2000          | US 6624828 B1<br>AU 2974800 A<br>EP 1163656 A1<br>JP 2002536677 T<br>WO 0045365 A1  | 23-09-2003<br>18-08-2000<br>19-12-2001<br>29-10-2002<br>03-08-2000   |